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EFFECTS OF DISTANCE LEARNING: A SUMMARY OF THE LITERATURE

Paper for
Congress of the United States
Office of Technology Assessment

Michael G. Moore
Assoc. Professor, Penn State University
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TABLE OF CONTENTS

Part A – Introduction
Meaning and perspective of distance education 1
Purpose and outline of the paper 2
History and international scope: A thumbnail sketch 2
Examples of distance education in the schools 3
Course design and student support 5
Student support 6

Part B – Literature Review
Learner achievement 7
Learner perceptions and attitudes 13
Instructor skills 15
Program design considerations 16
Course and curriculum development 19
Use of telecommunications for teacher inservice training 21
Professional development needs of distance educators 22
Cost effectiveness of distance education 24
State policies Dedicated to distance education. 26
A. Inventory studies 27
B. Policies 27
C. National/institutional policy development 28

Part C – Implications
General 30
The need for strategic planning 31
Implications regarding learning 32
Implications for teachers and teaching 32
Implications for media selection and usage 33
Implications concerning the quality of interaction 34
Implications for educational systems and organizations
Implications concerning documentation 34
Implications concerning policy formation 35
Conclusions regarding policy 36

CONCLUSION 37

EFFECTS OF DISTANCE LEARNING: A SUMMARY OF THE LITERATURE

MICHAEL G. MOORE

PART A
INTRODUCTION

MEANING AND PERSPECTIVE OF DISTANCE EDUCATION

The term "distance education" has been borrowed from the European terms, "Fernunterricht, "Tele-enseignement" and "Educación a Distancia" to describe all teaching-learning arrangements in which the learner and teacher are normally geographically separated, and to focus on the special nature of course design, learning and instruction under such circumstances.[1,2]

The most notable characteristic of all distance education is that communication between learners and teachers is through print and writing or by electronic media such as broadcasts, recordings, narrowcasts by cable, satellite, ITFS, and fiber transmission, interactive telecommunication by computer, audio and video teleconferences or, as is increasingly common, combinations of these media.

A second significant characteristic of distance education arises from the first. It consists of a new approach to instruction, with the process of teaching being broken into its constituent parts. Some or all of these are prepared away from the learner, and communicated to the learner through the communications technology, with the possibility of interaction between the learner and an instructor also being through communications technology. In distance education, courses are usually designed for distribution to audiences that are larger, and over geographic areas that are wider than conventional education. Although course materials are produced more centrally, local instructors help learners make individual sense of, and develop critical responses to them.

Because the work of many specialists is involved in course design and learner support, systems design principles are followed to integrate their work, to ensure the course is produced on schedule, and to ensure that instruction will have the maximum effect on a population that is both large and also very diverse. Because costly media are employed and also expensive specialists, and because they require considerable time to produce, the total cost of distance courses is much higher than conventional teaching. As a result of this investment they are likely to be of high quality compared to the work of individual teachers. To obtain economies, the cost can be amortized over a large student body so that the restructuring of resources results in LOWER per student costs even for higher quality instruction.

It is for these three reasons, summarized below, that questions of effectiveness have to be asked and answered, research and new training proposed:

1. Distance education uses technologies that are unfamiliar as the primary media of communication for teaching to most teachers and administrators.
2. Distance education requires teachers to specialize in the various functions of teaching, especially those of content expert, facilitator of interaction, course

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[1] Desmond Keegan , The Foundations of Distance Education (London: Croom Helm, 1986).

[2] Börje Holmberg, Growth and Structure of Distance Education (London: Croom Helm, 1986).

designer, and learner counsellor, and such distinctions are unfamiliar to most teachers and administrators.

3. Distance education requires planning, development, production and distribution on a larger scale than is familiar to most teachers and administrators, and requires major intervention by policy makers at national and state levels.

PURPOSE AND OUTLINE OF THE PAPER

In this paper, after a brief review of the general characteristics of distance education, a review of literature will report the research of the 1980s on the main issues in teaching, learning, educational planning, organization and policy making with regard to use of communications technology in contemporary distance education. The main focus will be on interactive telecommunications media i.e. audio, video, and computer teleconferencing. Although the broad field of education will be reviewed, including higher and continuing education, special attention will be given to K-12 education. The issues that will be identified and discussed are not those concerning the effectiveness of communications media per se, but the effects that their use have on certain educational variables, particularly on learners' achievement and attitudes, on teachers' achievement and attitudes, on course design and curriculum issues, on cost, administration and organization, and policy making in education.

HISTORY AND INTERNATIONAL SCOPE: A THUMBNAIL SKETCH

The origins of contemporary distance education are to be found in correspondence education, a method invented in the late 19th century to provide instruction to learners unable to attend a class, and subsequently adapted for use by classes who did not have access to teachers of particular subjects. Correspondence instruction remains an important method of distance education, though it is usually supplemented and is frequently replaced by electronic media. As early as 1938, educators concerned with the distant learner formed the International Council for Correspondence Education (ICCE). In recognition of the ascendancy of electronic media, the ICCE changed its name in 1982 to International Council for Distance Education (ICDE). At its most recent World Conference—in Oslo in 1988—there were some 600 delegates from over 50 countries, including more than 50 Americans.

In attempting to classify the many thousands of distance education organizations worldwide, Neil[3] distinguished between the "whole system control model" such as the British Open University and institutions that are "embedded into communities of educational agencies." These embedded institutions have to share authority with a parent organization in four areas of management where the "whole system" has autonomy. They are: finance, examinations and accreditation, curriculum and materials, and delivery and student support services. Until the present time the United States has not developed a whole system control model like the Open Universities, but has many examples of "embedded " institutions, including the Extension divisions of the universities. This is also the preeminent organizational form in Socialist countries. Nearly half the students in higher education in China, more than a million students, are distance learners. In the Soviet Union 30% of all students in higher education, i.e. some 1.5 million students, are in distance education, and in East Germany a quarter of the 1.7 million university and technical college graduates have attained their qualifications by distance education.

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[3] Michael Neil, Education of Adults at a Distance (London: Kogan Page, 1981), p.130.

In the United States, at the adult level, distance education has been embedded for many years in the corporate, military and university continuing education sectors. The communication medium traditionally used have been print, recording or broadcasting. In recent years these have been joined by various new forms of telecommunications, and in these technologies the United States leads most of the world. At the university level for example, membership of the National University Teleconference Network has grown to more than 260 organizations either providing or receiving a range of over 100 programs by satellite. In the National Technological University, 24 of the country's major universities collaborate to produce about 500 post-graduate courses in engineering delivered by satellite directly to more than 100 work places. More than 40% of Fortune 500 companies use video conferencing. The American Telephone and Telegraph Corporation for example expanded from 5 videoteleconference sites in 1983 to 130 in 1987. As well as corporation owned systems there are also a number of generic delivery systems. In 1982 there were two such "business videoconference" networks; by 1987 there were over 40. Examples are The American Rehabilitation Educational Network, providing professional continuing education for health care professionals at nearly 100 sites nationwide. Public bodies that use telecommunications satellites in their continuing education programs, organized by The Public Service Satellite Consortium include The American Hospital Association, The American Law Institute, American Bar Association Committee on Continuing Professional Education, The National Education Association, The AFL-CIO, and the U.S.Chamber of Commerce.

EXAMPLES OF DISTANCE EDUCATION IN THE SCHOOLS

The University of Nebraska-Lincoln Independent Study High School (ISHS) is a fully accredited high school which in 1988 school year recorded 12,412 high school course registrations. The school employs twenty-eight full and part-time teachers and has issued nearly one thousand diplomas in the past sixteen years.[4] Alaska and North Dakota have complete secondary correspondence schools.[5] Barker and Logan note that a high school in Washington expanded its course offerings from fifteen to one hundred through the addition of supervised correspondence study.[6]

Audio teleconferencing is especially popular as a means of bringing distant experts into the classroom. Examples have been found in New York where students talked to a rock musician in California,[7] and in North Carolina where students in the School of Science and Mathematics talked with historians and diplomats.[8] Nebraska's ISHS sponsors a TeleLanguage program which combines independent study and regular conference calls to

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[4] Independent School High School, informational materials (Lincoln, NE: University of Nebraska-Lincoln Independent Study High School, 1988).

[5] Leonard Valore and Grover E. Diehl, The Effectiveness and Acceptance of Home Study ERIC, ED 283 050 (Washington, DC: National Home Study Council, 1987).

[6] Bruce O. Barker and Suzanne Logan, 1985. "Small High Schools Curricula: Alternative Delivery Systems for Meeting Essential Elements" ERIC, ED 252 371 paper presented at the Annual Conference of the Texas Association of Secondary School Principals, 1985.

[7] Patrick Galvin, Telelearning and Audiographics: Four Case Studies (Norwich, NY: Delaware-Chenango BOCES, 1987).

[8] Virginia S. Wilson, James A. Little, and Gerald L. Wilson, "Audioteleconferencing as a Teaching Technique," Social Education, vol. 50, No. 2, 1986, pp. 90-92.

teach modern languages to students in twenty-four school districts.[9] High school math and science instruction is offered in Louisiana,[10] and in Tucson, Arizona the Homebound/ Teleteaching Program has allowed seriously ill or handicapped students to participate in classes through telephone hookups.[11]

Computer conferencing was recently used by second graders in Illinois to "talk" with a children's book author.[12] Students in Hawaii have combined audio and computer-based messaging to bring in guest speakers and communicate with other students in Massachusetts, Japan, and other locations.[13] AT&T is piloting a "Long Distance Learning Network" in over three hundred classrooms in six different countries.[14]

Audiographics and a teleconferencing bridge have been used since 1985 in New York to connect as many as five rural schools at a time to deliver advanced high school courses.[15,16] Garfield County, Utah's Tele-Learning Network and the Pennsylvania Teleteaching Project also use audiographics in schools.[17]

Twenty-eight school districts in Virginia were linked through a combination of ITFS and open broadcast, and fourteen ITFS centers in South Carolina served 380 schools.[18] Two large systems in Richardson and Houston, Texas serve a total of eighty schools[19]; Houston's InterAct network alone covers seven counties.[20]

The Chico campus of the University of California originates interactive video programs delivered to schools by fiber optics.

Microwave technology has linked three small rural schools in Iowa[21] and two in Michigan in separate interactive television programs.

Siegmund and McFadden[22] describe the Carroll (IL) Instructional Television Consortium, a cable-based system, which joined four districts to offer six courses in 1984-85.

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[9] Milan Wall, Information Technologies: Alternative Delivery Systems for Rural Schools: An Update ERIC, ED 270 253 (Aurora, CO: Mid Continent Regional Education Laboratory, 1985).

[10] Jerry K. Pinsel, Distance Learning: A Summary of Telecommunications Efforts Involving Education Service Agencies and Others (Arlington, VA: American Association of Education Service Agencies, 1988).

[11] Heather E. Hudson and Charles H. Boyd, Distance Learning: A Review for Educators ERIC, ED 246 872 (Austin, TX: Southwest Educational Development Laboratory, 1984).

[12] Marianne Handler, "Meeting an Author Online," The Computing Teacher, vol. 16, No. 2, 1988, pp.17-19.

[13] John H. Southworth and E. Barbara Klemm,"Increasing Global Understanding Through Telecommunications," NASSP Bulletin, vol. 69, No. 480, 1985, pp. 39-49.

[14] AT&T Long Distance Learning Network, informational materials (Basking Ridge, NJ: AT&T, 1988).

[15] Gregory M. Benson, Jr. and William Hirschen,"Distance Learning - New Windows for Education," T.H.E. Journal, vol. 15, No. 1, 1987, pp. 63-67.

[16] Galvin, op. cit.

[17] Bruce O. Barker, Interactive Distance Learning Technologies for Small Rural Schools: A Resource Guide (Las Cruces, NM: ERIC Clearinghouse on Rural Education and Small Schools, 1987).

[18] Pinsel, op. cit.

[19] Barker, op. cit.

[20] Hudson and Boyd, op. cit.

[21] Robert N. Nelson, "Two-Way Microwave Transmission Consolidates, Improves Education," NASSP Bulletin, vol. 69, No. 484, 1985, pp. 38-42.

[22] Don E. Siegmund and Joel McFadden, "Linking Smaller Schools for a More Effective Curriculum," NASSP Bulletin , vol. 69, No.484, pp. 35-38.

Pinsel[23] writes that in 1986 six hundred school buildings in the United States owned satellite receiving equipment. Among the large scale satellite efforts is the TI-IN service, which broadcasts courses to high schools around the country from Texas. TI-IN sends nearly two dozen courses over the air waves five days a week.[24] The Arts and Sciences Teleconferencing Service, based at Oklahoma State University, began offering high school German in 1985 and has since added Calculus, Physics, History and Government.[25,26,27] Other satellite programs for schools include Kentucky Educational Television (KET), which recently received funding to provide downlinks at all schools; the LearnAlaska network which served 250 communities in that state[28]; a system in Utah that delivers Spanish to more than two dozen schools[29]; and The Satellite Telecommunications Educational Programming Network in Spokane, Washington.[30]

Television programs broadcast by the Public Broadcast System have been used in schools for many years, and the commercial networks are beginning to offer more programs, such as the mini-series "Roots," complete with teacher support materials. As allowed by law, regional agencies and local schools often tape programs for delayed classroom use. Pinsel[31] discusses other technologies being used by schools in the United States.

COURSE DESIGN AND STUDENT SUPPORT

Designing distance learning materials means organizing and controlling the work of many specialists including subject authors, instructional technologists, illustrators, television, recording and other media specialists, librarians, photo-librarians, and editors. Teams used in many Open Universities may be as large as 20 people, and have budgets of several million dollars for one course. The purpose of their work is to structure academic content in a form suitable for study by distant learners. Devices to ensure feedback must be constructed[32] as well as to provide for the different pace at which students learn.[33] Instruments for the evaluation of learning must be designed. Multiple copies of course materials must be produced and distributed either as printed packages, or by electronic means.

An alternative to the course team is the "author-editor" approach in which a sole academic is contracted to write course content for editing into a teaching program by professional editors. While this approach has been traditional in correspondence education, an analogue is seen in teaching by electronic media, when content is contributed by an expert,

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[23] Pinsel, op. cit.

[24] G. Christopher Clark, "What Goes Up Must Come Down: Learning by Satellite," The Computing Teacher, vol. 16, No. 2, 1988, pp. 13-15.

[25] Sally L. Bond, Telecommunications-Based Distance Learning: A Guide for Local Educators ERIC, ED 287 474 (Research Triangle Park, NC: Southeast Educational Improvement Laboratory, 1987).

[26] Clark, op. cit.

[27] Arts and Sciences Teleconferencing Service, program description book (Stillwater, OK: Oklahoma State University Arts and Sciences Teleconferencing Service, 1988).

[28] Bond, op. cit.

[29] Pinsel, op. cit.

[30] Clark, op. cit.

[31] Pinsel, op. cit.

[32] Dawn C. Howard, "Designing Learner Feedback in Distance Education," The American Journal of Distance Education, vol. 1, No. 3, 1987, pp.24-40.

[33] Doug G. Shale, "Pacing in Distance Education: Something for Everyone?" The American Journal of Distance Education, vol. 1, No. 2, 1987, pp. 21-33.

and produced by telecommunications specialists. A major weakness of such author-editor arrangements is that neither expert is usually an instructional designer.

When considering course design, some of the new media are of special significance, since they are more powerful for communicating several of the processes of instruction than were older media. For example electronic mail and computer conferencing offer new opportunities for student involvement and participation in instruction. However the excitement of using new varieties of electronic media sometimes distracts educators and others from making the most suitable selections of media. Wagner and Reddy warn against educational decision making that is "hardware driven"[34] and insist that electronic media must "be selected according to instructional needs, professional and technical expertise, and according to one's available budget." "The greatest problem" Bates writes, "is deciding which media to use, and the different ways in which each medium should be used so that they complement one another....It is a great pity that as much energy and investment is not put into this as there is in media production and distribution."[35]

STUDENT SUPPORT

The literature suggests that a requirement for successful distance education may be a carefully designed and maintained learner support system. In such a system, teachers, highly qualified and experienced in the understanding of learners and learning, but not necessarily in the academic subject, support students by : providing skilled diagnostic counselling and orientation programs; assisting students to organize their time and develop their study skills; providing active tutorial assistance during the course, face-to-face if needed and feasible; monitoring written work not only for cognitive achievement but for affective responses; ensuring that instructors involve students in the instruction of the course; and giving assistance when illness, financial, family or work difficulties threaten to overpower the motivation to study.[36,37]

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[34] Ellen D. Wagner and Nancy L. Reddy, "Design Considerations in Selecting Teleconferencing for Instruction," The American Journal of Distance Education, vol. 1, No. 3, 1987, p. 49.

[35] A. Bates (ed.), The Role of Technology in Distance Education (London: Croom Helm, 1984), p. 227.

[36] G. Rumble and Keith Harry (eds.), The Distance Teaching Universities (London: Croom Helm, 1982), p. 222.

[37] Charles Feasley, Serving Learners at a Distance: a Guide to Program Practice (Washington, DC: ASHE ERIC Higher Education Research Report No. 5, 1983).

PART B.
STUDIES OF EFFECTIVENESS OF DISTANCE EDUCATION BY INTERACTIVE TECHNOLOGIES — "TELECONFERENCING"

LEARNER ACHIEVEMENT

K-12

Literature on distance education in general and the effective use of interactive technologies in particular in schools (K-12) is scarce, and that which is available consists mainly of case studies, opinions, and advice. Eiserman and Williams[38] found that of 503 documents pertaining to the general topic of distance education, most dealt with its application to Higher Education, specifically program descriptions and problems encountered in Higher Education settings. As they point out, "while it is possible that some of what is being learned about the various components of distance education is relevant to its use in public schools (K-12), there is no evidence of any empirically founded comparisons."

Of the 503 documents they identified, only 46 specifically related use of distance education and technologies to schools: 22 were position papers, 7 described instructional materials, 3 pertained to technical components, 5 were reviews of research, and 9 were primary research studies. Even these last 14 articles provided little or no empirical evidence to support claims of general effectiveness. Additionally, although all reports claimed positive results, they defined effectiveness in a variety of ways, which included:

1. The extent to which programs are made available to students who otherwise would be deprived
2. How cost effective the program is
3. How diverse the students educational experience is
4. Cognitive and/or skill gains
5. The degree to which teacher loads are eased

Additionally, Eiserman and Williams found no studies comparing effectiveness of instruction across types of populations (general K-12; exceptional students), no effectiveness data comparing different content areas, and none comparing the effectiveness of instruction using different instructional designs.

Batey and Cowell,[39] in their overview of distance education, suggest that, while there has been little systematic evaluation of the educational effectiveness of distance education at the K-12 level, that which has been conducted (both K-12 and postsecondary) indicates that students learn as well in distance education programs as they do in regular programs and that student attitudes toward such programs are generally positive. They also believe effectiveness is reflected in often unanticipated side effects of distance programming implementation: higher levels of communication/ cooperation between schools and districts, parental involvement with courses, and exposure to or mastery of a new technology which students and teachers can apply to other areas.

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[38] William D. Eiserman and David D. Williams, Statewide Evaluation Report on Productivity Project Studies Related to Improved Use of Technology to Extend Educational Programs, Sub-Report Two: Distance Education in Elementary and Secondary Schools, A Review of the Literature ERIC, ED 291 350 (Logan, UT: Wasatch Institute for Research and Evaluation, 1987).

[39] Anne Batey and Richard N. Cowell, Distance Education: An Overview ERIC, ED 278 519 (Portland, OR: Northwest Regional Educational Laboratory, 1986).

A nationwide telephone survey sponsored by the Utah State Office of Education sought to provide information on the effectiveness of technology-based elementary and secondary educational projects[40]; the findings reflect the lack of systematic evaluation reported by others. Thirty-eight per cent of the schools surveyed reported no evaluations for the programs they described; 51% stated that they performed evaluations, but only 20% provided evidence. Aspects of effectiveness reported include enhanced equity between small rural schools and their larger counterparts, expanded curricula through the use of additional learning experiences and exposure to famous personalities, and high levels of acceptance by students, parents, and teachers.

Teachers and administrators in Iowa's two-way interactive television (TWIT) project found no significant differences between TWIT classes and other sections of the same class taught face-to-face by the same teacher.[41] Daily lesson scores, test scores, quarter and semester grades, and levels of participation were comparable for the two groups.

The Carroll Instructional Television Consortium, formed to increase the total number of course offerings, promote achievement as measured by content mastery of advanced level course work, and increase the efficiency of teacher instructional time in four rural Illinois high schools, has been in operation since 1983. Robinson,[42] in his study of the program, reports that the project was effective in terms of expanded curricula and higher levels of teacher efficiency. Teacher effectiveness was perceived to be above average, and students in remote interactive television classes achieved as well on post-tests as did students in traditional classrooms.

In testimony to the Senate Committee of Labor and Human Services, Kitchen[43] reported on the effectiveness of interactive television (ITV) in rural school districts in Minnesota. He states that, in a wide range of elective programming provided from 1983 to 1986, no statistically significant differences in achievement were found between students taking courses traditionally and by ITV.

Barker[44] reports on a survey to determine perceptions of effectiveness of thirty high school principals involved with the TI-In satellite network, which broadcasts courses from Texas to high schools around the country. Student-teacher interaction was rated "very good" or "excellent" by 77% of the respondents; quality of instruction was rated as "very good" or "excellent" by 74% of the respondents. Barker did not elaborate on the criteria used to measure these factors.

Braucher,[45] in an interesting anecdotal report, perceives and evaluates the effectiveness of audioteleconferencing classes for homebound junior and senior high school stu-

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[40] D. William Quinn and David D. Williams, Statewide Evaluation Report on Productivity Project Studies Related to Improved Use of Technology to Extend Educational Programs, Sub-Report Three Survey of Technology Projects Throughout the United States ERIC, ED 291 351 (Logan, UT: Wasatch Institute for Research and Development, 1987).

[41] Nelson, op. cit.

[42] R. Robinson, "An Investigation of Technical Innovation: Interactive T.V." ERIC, ED 256 331. Paper presented at the Annual Convention of the Association for Educational Communications and Technology, (Anaheim, CA: Jan. 17-23, 1985).

[43] Will Kitchen, "Education and Telecommunications: Partners in Progress" ERIC, ED 282 551 (Testimony Before the Senate Committee on Labor and Human Services, March 11, 1987).

[44] Barker, op. cit.

[45] B. H. Braucher, "Teleteaching: Interaction on a Shoestring," Teleconferencing and Electronic Communications II, L. Parker and C. Olgren, (eds.) (Madison, WI: University of Wisconsin Extension, Center for Interactive Programs, 1983), pp. 64-72.

dents from the perspective of the surprisingly high levels of interaction possible with this medium. She suggests some possible factors relating to this situation:

1. familiar surroundings, which lead to feelings of comfort and security
2. absence of distractions
3. privacy (and invisibility), which precludes much embarrassment and accompanying stress
4. smaller classes and, therefore, familiar classmates

Braucher contends that teleteaching is highly interactive and, since "it is interaction itself which instructs," [46] highly effective. She, too, would like to see empirical evidence to support her anecdotal evidence:

> Almost every activity in teleclasses has an exact match in conventional classrooms. Yet the results seem to be better in our teleclasses than in the classroom.
>
> There are a number of possible explanations for the greater effectiveness of teleclass interaction. None of them has been officially researched, however. We offer them only as intuitions and hope that a study in the near future will verify what we now can only suspect.[47]

As Eiserman and Williams[48] suggest, although much of the literature is vague and overly general, several important conclusions with implications for effectiveness can be drawn from what is currently being written:

1. Although current programs are at various stages of implementation, most are still in the initial stages of planning.
2. Those programs which have gone beyond the initial stages have been accepted by state accreditation and have resulted in expanded curricular offerings.
3. Distance education programs are effective in providing educational service to those who would otherwise be unserved.
4. To maximize benefits from new technologies, developers are finding new applications (such as for teacher training) for distance education technologies.

Adults

In the literature pertaining to the use of educational technologies for the delivery of educational programming to adults, opinion papers, case studies, and advice again predominate. However, empirical studies have also been conducted to validate claims of effectiveness as well as to quantify such aspects of teleconferencing as facilitator behaviors, participant satisfaction, and cost-effectiveness.

A number of studies, especially early ones, compare the effectiveness of teleconferencing with face-to-face instruction. These studies were conducted with various adult populations (non-credit students, undergraduate students, graduate students, medical personnel, military personnel, elementary school teachers, laboratory subjects, etc.) and in a variety of content areas (finance, library science, psychology, mathematics, etc.) and all conclude that delivery of educational programming via teleconferencing is educationally effective.

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[46] Ibid., p. 64.
[47] Ibid., p. 67.
[48] Eiserman and Williams, op. cit.

To determine the effectiveness of audioteleconferencing as a means of delivering educational information, Blackwood and Trent[49] performed a study of adults participating in a Cooperative Extension class ("Money Management") They report that there was no difference in the amount learned by telelecture and by face-to-face teaching, and that there were no associations between the amount of learning which occurred via each method and the variables of age, level of education, time of day, and attitude.

Boswell, Mocker, and Hamlin[50] compared the result of remote teaching and face-to-face instruction in three classes of Introductory Psychology. Pre- and post-test results showed no significant differences in mastery of content; student course evaluations showed no difference in student attitudes.

To examine differences in student achievement and attitudes in college classes taught by traditional instruction and by audio teleconferencing and Electrowriter, Puzzuoli[51] conducted a study of university Extension classes. He concluded from a comparative analysis of achievement of the two groups that the remote classes performed as well or significantly better than the resident students, and that student attitudes varied depending on the telelecture model used.

Hoyt and Frye[52] compared the educational effectiveness of six undergraduate and graduate level courses taught by audio teleconference with that of identical on-campus classes. Evaluation included instructor assessment of achievement (post-test scores on achievement tests, final exam grades, final course grades) and student evaluation of the extent to which personal goals were met. The authors concluded that instruction via audio conferencing was as effective as that delivered traditionally.

Chapanis[53] focused on human factors in telecommunications and the influence of these factors on effective learning. He discusses 1) how people naturally communicate to solve problems of various types, 2) how interactive communication is affected by technological devices and systems, and 3) what system and human variables affect interactive communication. He concludes that some communication tasks common in educational settings, such as exchanging information or opinions, solving problems, and generating ideas, are as effectively carried out in electronically mediated situations as in face-to-face situations.

Christopher[54] discusses a system for providing instruction to Air Force students at remote sites in eight states via the Tele-teach Expanded Delivery System (TEDS). He concludes, on the basis of statistical analysis of test scores, that students learned at least as well as resident students and that student attitudes were positive, especially for shorter courses.

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[49] H. Blackwood and C. Trent, A Comparison of the Effectiveness of Face-to-Face and Remote Teaching in Communicating Educational Information to Adults ERIC, ED 028 324 (Manhatten, KS: Kansas State University, Cooperative Extension Service, 1968).

[50] J. J. Boswell, D. W. Mocker, and W. C. Hamlin, "Telelecture: An Experiment in Remote Teaching," Adult Leadership, vol. 16, No. 9, 1968, pp. 321-322, 338.

[51] D. Puzzuoli, A Study of Teaching University Extension Classes by Tele-lecture ERIC, ED 042 961 (Morgantown, WV: West Virginia University, 1970).

[52] D. P. Hoyt and D. Frye, "The Effectiveness of Telecommunications as an Educational Delivery System," unpublished manuscript ERIC, ED 070 318 (Manhatten, KS: Kansas State University, 1972).

[53] A. Chapanis, Human Factors in Teleconferencing Systems: Final Report ERIC, ED 163 902 (Baltimore, MD: Johns Hopkins University, Department of Psychology, 1976).

[54] G. R. Christopher, "The Air Force Institute of Technology--The Air Force Reaches Out Through Media: An Update," Teleconferencing and Electronic Communications, L. Parker and C. Olgren, (eds.) (Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs, 1982), pp. 343-44.

In another study of educational technology in the military, Partin and Atkins[55] measured the effectiveness of an audioteleconferencing system supplemented by an electronic blackboard for the delivery of educational programs to Department of Defense managers. Data collected was used to compare the achievement and attitudes of students in teleteach and traditional classes. The authors report that for one of the two courses examined, the percentage of A's and B's was considerably less in the teleteach classes (40% and 54%) than in the resident classes (73%); for the other course, the percentage of A's and B's in the teleteach class (88%) was comparable to that in the resident classes (83%).

Kruh[56] reports on results of a study of six university courses taught by teleconferencing compared to courses taught in the traditional manner. She provides sample evaluation forms, describes the treatment of data from student evaluations, and concludes that academic achievement and student satisfaction in teleconferencing classes is equal to that of students in resident classes.

A project to increase the availability of continuing education to nurses and to develop and evaluate alternative educational delivery methods is described by Kuramoto.[57] Evaluation was conducted on the basis of learners' academic performance and learners' attitudes and behaviors. Eight variables, including cognitive pre- and post-test scores, attitude scores, intent to use and actual use of course content, attendance, and attrition were analyzed to assess effectiveness. She concludes that all three delivery methods evaluated (face-to-face, teleconferencing, and correspondence study) were effective in terms of increasing cognitive knowledge and that findings related to attitude were mixed and inconclusive.

To determine the validity of the belief that classroom instruction is inherently superior to alternative delivery systems, such as teleconferencing, Weingand[58] analyzed differences in the performance of student in a graduate level library science course taught both by teleconferencing and in the traditional classroom setting. He concludes that 1) there is no evidence to support the idea that face-to-face instruction is the optimum delivery method, 2) instruction by teleconferencing can facilitate learning as well as or better than can classroom instruction, and 3) the absence of face-to-face contact is not detrimental to the learning process.

Chute, Bruning, and Hulick[59] compared multi-modes of delivery and student achievement outcomes. Two groups, one taught traditionally and one via teleconferencing (electronic conference board, two-way voice, and graphics), were presented with identical content and hours of instruction. Although the pretest scores of the two groups were not significantly different, the posttest scores of the teletrained group were significantly higher than those of the traditional classroom group. The authors conclude that the teletrained group learned as well, if not better, than the face-to-face group.

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[55] G. R. Partin and E. L. Atkins, "Teaching Via the Electronic Blackboard," Teleconferencing and Electronic Communications III, L. Parker and C. Olgren, (eds.) (Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs, 1984), pp.68-73.

[56] J. Kruh, "Student Evaluation of Instructional Teleconferencing," Teleconferencing and Electronic Communications II, (1983), pp. 293-301.

[57] A. Kuramoto, "Teleconferencing for Nurses: Evaluating Its Effectiveness," Teleconferencing and Electronic Communications III, (1984), pp. 262-268.

[58] D. E. Weingand, "Telecommunications and the Traditional Classroom: A Study of the Delivery of Education," Teleconferencing and Electronic Communications III, (1984), pp. 269-274.

[59] Alan G. Chute, K. K. Bruning, and M. K. Hulick, The AT&T Communications National Teletraining Network: Applications, Benefits, and Costs (Cincinnati, OH: AT&T Communications Sales and Marketing Education, 1984).

Vandehaar[60] examined the concept of educational effectiveness from a broader perspective than that of other writers. Believing that measures of effectiveness should include dimensions other than cognitive development, she investigated the extent to which the basic configuration and procedures of teleconferencing classrooms encourage or limit the seven vectors of student development described by Arthur Chickering, a student development scholar. She concludes that, although student cognitive development is comparable to that in traditional classes, "current use of the teleconference classroom basically accomplishes data movement, not quality learning as described by Chickering."[61] Although teleconferencing, as currently implemented does not serve to foster multiple dimensions of student development, Vandehaar believes that none of the barriers to development is the direct result of the teleconferencing format, but rather results from limited or inappropriate teaching behaviors and implementation on the part of instructors. Such a conclusion has important implications for the proper training of instructors in the teleconference classroom.

LEARNER PERCEPTIONS AND ATTITUDES

Researchers and reviewers have looked at the subject of learner attitudes from several perspectives. Some are concerned with merely assessing (qualitatively or quantitatively) the level of learner satisfaction with distance education courses ; others attempt to discover the extent to which students perceive communications technologies to affect the teaching/learning transaction; some address the concept of student perception of effective teaching behaviors; a few discuss ways of changing user attitudes.

K-12

Several of the authors mentioned earlier provide general reports of positive student attitudes to telecommunications.[62,63] Two authors who attempt to quantify student perceptions report mixed results.

Nelson[64] reports that when students instructed via the Iowa TWIT system were surveyed regarding their perceptions of the programming, 97% indicated no more problems in the televised classes than in traditional classes; 67% believed they accepted more responsibility for their behavior and learning in TWIT classes; 97% indicated a willingness to enroll in another televised class; and 94% believed their level of achievement was as high or higher in televised classes.

Barker,[65] in his survey of TI-IN students, found that 24% of the students perceived satellite courses to have the same level of difficulty as their regular class; 65% believed them to be more difficult. Almost 70% of the students indicated that they would choose a traditionally instructed course over a satellite course. The main weaknesses reported by students included too much work, difficulty in hearing, difficulty contacting the teacher, and inadequate teacher preparation and training. Strengths reported included increased

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[60] Debb Vandehaar, "Learning Betweeen Here and There: Qualiuty Teleconference Classrooms," Teleconferencing and Electronic Communications V, L. Parker and C. Olgren, (eds.) (Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs, 1986).

[61] Vandehaar, op. cit., p.342

[62] Batey and Cowell, op. cit.

[63] Quinn and Williams, op. cit.

[64] Nelson, op. cit.

[65] Bruce O. Barker, "The Effects of Learning by Satellite on Rural Schools," ERIC, ED 284 693, Paper presented at Learning by Satellite Conference, Tulsa, OK, April 12-14, 1987.

course offerings and varied and interesting instruction. Students recommended that the quality of the audio be improved, that larger monitors be installed, and that the reception equipment be kept in good repair.

Adults

Many of the studies discussed in the section on effectiveness[66,67,68,69] indicate that general adult student attitudes toward telecommunications are positive. More specific aspects of student attitudes are addressed by Smeltzer,[70] who investigated the effects of electronic communication on the variables of student stimulation, reinforcement, and participation. He reports on a study to determine students' perception of the extent to which the quality of the teaching/learning transaction is affected by the teleteaching format and presents qualitative and quantitative evidence that audio teleconferencing does not preclude communications-rich interactions between participants. Davis,[71] however, in a study comparing instruction via teleconferencing, face-to-face teaching, or a combination of the two methods, found that face-to-face delivery results in more positive attitudes; as face-to-face contact increases, so does learner satisfaction with method instruction. There was no significant relationship, however, between attitude and achievement.

Partin and Atkins[72] report that DOD managers in teleteach courses are generally receptive to technological delivery. Based on student responses to an evaluation questionnaire, the authors conclude that students perceive distance delivery to be an effective learning experience unhindered by the physical absence of an instructor. Students indicated that the presence of a facilitator at each site and the proper functioning of equipment were important considerations in their satisfaction with the teleconferencing experience.

In investigating student perception of teaching behaviors necessary for effectively delivering courses both conventionally and via teleconferencing, Haaland and Newby[73] observed five statistically significant differences in the frequency of effective teaching behaviors of those teaching by teleconference. Effective teleconference teachers: 1) used students' names, 2) set out clear statements of purpose, 3) made use of printed material, 4) encouraged discussion, and 5) did not speak in a monotone. The authors conclude that the delivery mode has no effect on students' overall rating of the courses or on ratings of instructors' ability.

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66 Boswell, Mocker, and Hamlin, op. cit.

67 Hoyt and Frye, op. cit.

68 Christopher, op. cit.

69 Kruh, op. cit.

70 L. R. Smeltzer, "An Analysis of Receivers' Reactions to Electronically Mediated Communication," The Journal of Business Communication, vol. 23, No. 4, 1986, pp. 37-54.

71 D. J. Davis, "Evaluation and Comparison of Teleconference Training with Face-to-Face Training and the Effects on Attitude and Learning," Dissertation Abstracts International, Vol. 46, No. AAC850579, 1984.

72 Partin and Atkins, op. cit.

73 B. A. Haaland and W. G. Newby, "Student Perception of Effective Teaching Behaviors: An Examination of Conventional and Teleconference Based Instruction," Teleconferencing and Electronic Communications III, (1984), pp. 211-17.

Shaeffer and Roel,[74] in a study to empirically determine which teaching behaviors students consider necessary in teleconferencing and in face-to-face courses found differences in students perceptions of the two delivery modes, however. Using group interviews and questionnaires to obtain student feedback, they discovered that on the basis of perceptions of instructor clarity, enthusiasm, organization, pacing, and encouragement of student participation, students in teleconferencing courses gave higher ratings of the course and the instructor's teaching ability than did those in the face to face course. They suggest that these differences perhaps result from the instructor's attempt to alter behavior because of a knowledge of appropriate teleteaching techniques, techniques which, if used, may heighten student satisfaction with face-to-face instruction, as well.

Pryor[75] addresses the variable of student attitudes from the perspective of understanding and changing attitudes, and thus behaviors. He discusses the problem of user resistance to teleconferencing in terms of resistance to change, and the idea that participant attitudes directly affect behaviors in a teleconferencing situation. He presents a model for understanding and evaluating attitudes and behaviors, and a model for changing negative attitudes and behaviors toward teleconferencing. Bevan[76] also examines the concept of changing user attitudes. Viewing user reaction in terms of uncertainty, stress, and the need to change, he concludes that training and technical help for participants should be based on proven techniques from the psychological and sociological disciplines, and presents strategies for assisting users in making attitudinal and behavioral changes necessary to perceive teleconferencing as a non-threatening communication tool.

INSTRUCTOR SKILLS

Many instructor behaviors which contribute to effective teaching are visual behaviors: eye contact, gestures, facial expressions, etc. Distance education instructors in many media must replace such behaviors with alternative actions; they must also develop a repertoire of behaviors unique to the distance teaching experience in order to enhance the overall teaching/learning transaction. The literature reflects general agreement that most of these skills are necessary and appropriate for teachers at any level of instruction.

Bronstein, Gill, and Koneman[77] contend that those teaching via teleconferencing must make adjustments in their delivery style in order to enhance their instruction. They provide the following guidelines for instructional delivery:

1. Be prompt in coming on the line. The program must start on time.
2. Use a natural style of delivery; speak slowly and enunciate clearly.
3. Maintain spontaneity; avoid reading from a script.
4. Use visuals effectively and verbalize appropriate guideposts.
5. Use frequent change of pace or stimuli to maintain interest.
6. Make frequent attempts to draw participants into discussions.

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[74] J. M. Shaeffer and R. G. Roel, "Effective Teaching Behaviors as Perceived by Students in a Face-to-Face and Teleconferencing Course," Teleconferencing and Electronic Communications IV, L. Parker and C. Olgren, (eds.) (Madison, WI: University of Wisconsin-Extension, Center for Interactive Programs, 1985), pp. 216-222.

[75] B. W. Pryor, "Increasing User Acceptance of Teleconferencing: A Model for Understanding and Changing User Behaviors," Teleconferencing and Electronic Communications IV, (1985), pp. 199-209.

[76] D. Bevan, "Making Teleconferencing Stick," Teleconferencing and Electronic Communications II, (1983). pp. 250-53.

[77] R. Bronstein, J. Gill, and E. Koneman, Teleconferencing: A Practical Guide to Teaching by Telephone (Chicago, IL: American Society of Clinical Pathologists Press, 1982).

7. Always refer to participants by name.
8. Give short concluding summary of concepts presented.

A number of other authors[78,79,80,81] list similar skills needed by successful teleconferencing teachers.

As Boone and Bassett [82] point out, identification of these specific skills appropriate to distance teaching has been based primarily on personal opinions rather than on systematic evaluations. Yet, as noted above, similar or identical skills are listed as important to the success of teleconferencing by many different authors. To discover the extent to which this "common wisdom" regarding necessary skills is well-founded, Boone and Bassett conducted a study in which "expert opinion" was used to verify the appropriateness of skills identified by a extensive examination of the literature. In looking at the categories of facilitator skills (before, during, and after a meeting or class) and participant skills, they found a high correlation between skills identified as important in the literature and those identified by teleconferencing experts. Additionally, they identified which skills, based on empirical evidence, could effectively be taught. Specific oral communication skills identified include: 1) pronunciation and articulation, 2) fluency, 3) rate of speech, 4) inflection, 5) volume of speech, 6) pausing, 7) positive feedback statements, 8) conversational questions, 9) compliments and appreciation statements, 10) anecdotes, 11) latency of response time, and 12) duration of oral statements.

In a follow-up study, Boone[83] attempted to operationalize some of the more "ambiguous" teleconferencing skills mentioned in the literature. Analysis of tapes of actual audioconferences provided specific examples of such skills, which include the abilities to:

1. provide structure (uses authority; controls verbal traffic)
2. provide socio-emotional support (integrates late group member; encourages humor)
3. establish a democratic atmosphere (shares authority; asks for participation)
4. create a sense of shared space (describes environment; creates a sense of shared history, when possible)
5. model appropriate behavior (models conciseness)
6. clarify (asks for confirmation; seeks common definition of terms)
7. repair sessions threatening to go awry (explains absence of group member; repairs interruptions)
8. set an appropriate pace (asks for conciseness; directs questions to a limited audience)

She concludes that any teleconferencing experience is only as effective as its facilitator; for this reason major emphasis should be placed on the appropriate training of instructors who teach via teleconferencing.

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[78] M. Monson, Bridging the Distance: An Instructional Guide to Teleconferencing (Madison, WI: University of Wisconsin Extension, 1980).

[79] S. Pereyra, "Human Factors in Establishing an In-House, Meet-Me System," Teleconferencing and Interactive Media, L Parker and C. Olgren, (eds.) (Madison, WI: University of Wisconsin Extension, Center for Interactive Programs, 1980).

[80] M. E. Boone and R. E. Bassett, "Training People to Audioconference: A Review of the Current Wisdom, Teleconferencing and Electronic Communications II, (1983). pp. 333-340.

[81] L. Parker, Teletraining Means Business (Madison, WI: University of Wisconsin Extension, Center for Interactive Programs, 1984).

[82] Boone and Bassett, op. cit.

[83] M. E. Boone, "Examining Excellence: An Analysis of Facilitator Behaviors in Actual Audio Teleconferences," Teleconferencing and Electronic Communications III, (1984), pp. 218-22.

Braucher[84] stresses the extent to which effective teaching behaviors are the same for teleteachers and for classroom teachers. She suggests that developing a friendly atmosphere, accurately transmitting feelings by tone of voice, carefully selecting words, appropriately using silences, showing respect for fragile adolescent egos, and thoughtfully integrating new students are skills which distinguish effective teachers in any setting or delivery situation.

PROGRAM DESIGN CONSIDERATIONS

The unique characteristics of the distance education experience often require either unique design elements or original methods of implementation for more traditional elements.

Batey and Cowell[85] contend that differences between distance education and traditional education demand new program management skills. They list a variety of management considerations likely to require new approaches:

establishing lines of responsibility
obtaining and handling funds
planning
record keeping and reporting
supervising students
obtaining, managing and repairing equipment
scheduling classes
scheduling existing staff
recruiting new staff
managing program change and updating program content
managing contracts and financial agreements
cooperating with other educators
dealing with new entities in the community and occasionally with new clientele[86]

Additionally, these authors suggest that distance education design and management considerations at the building, district, and higher levels are in many ways similar to those of business and industry than to those of traditional education programs. New issues of this type which will need to be addressed include FCC and government regulations, state approval for new curricular changes, certification and accreditation implications for instructors, cooperation with other districts, and community public relations campaigns.

Finally, Batey and Cowell emphasize the importance of incorporating evaluation strategies into any distance education project. They contend that an evaluator should be included on the program development team and should participate in both the design and implementation of projects. The following suggestions for formative and summative evaluations are offered in their publication:

Formative Evaluation

conducting a thorough needs assessment
studying the context in which the project will operate
analyzing policy and procedural alternatives
monitoring all major activities and processes of both development and implementation

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[84] Braucher, op. cit.
[85] Batey and Cowell, op. cit.
[86] Ibid., pp.21-22

determining the effectiveness of interim products, processes, systems,
providing continuous input to the design team
identifying problem areas

Summative Evaluation

determining the success of major components, programs, and systems
determining the success of the project as a whole
measuring student completion rates, achievement gains, and
measuring reactions and opinions of teachers, administrators, and the community in which the project is taking place
measuring side effects and unanticipated outcomes
determining desirable modifications for the next development cycle of the project or for the next project
suggesting appropriate next steps[87]

Norenberg and Lundblad,[88] in their general review of distance education in secondary, post-secondary and adult education, contend that distance delivery of educational programming places unique conditions on the learning environment, conditions which must be addressed in the initial stages of program design. Since each technology alters the role of instructors, affects learners, and influences the appropriateness of instructional design in a different manner, media selection is an issue of major importance. They suggest that media selection in a given situation depends on a number of factors, including the objectives of the organization, initial cost, personnel, users, anticipated use, level of interactivity desire, technological infrastructure already in place, legal considerations, topographical context, equipment compatibility, governmental and school jurisdictions, business service areas, and cost of operation.

In order to assist in important initial design decisions, Norenberg and Lundblad have developed two planning matrices addressing a variety of design considerations. Matrix 1 presents general, learner, teacher, and pedagogical considerations for each medium or technology; Matrix 2 presents technology costs, advantages, and limitations. These matrices, by illustrating the differences between the technologies and their applications to different educational settings, can aid distance education planners in their educational and management decisions.

The North Carolina Office of Day Care Services, in a comprehensive study of the feasibility of using telecommunications to train child day care workers, examined a number of design considerations, including budgeting, selection of media, and evaluation.[89] They tested four alternative training approaches: audio, audio/video, slow-scan, and traditional (face-to-face). Results indicate that significant gains in knowledge were made by students in all of the training situations, that students were extremely enthusiastic about all four methods of training, and that, in this situation, only audio training was cost-effective. The authors conclude that a realistic plan for the implementation of teleconferencing instruction depends upon the following design considerations: location of the teleconference centers; selection of appropriate telecommunications technology; development of content appropri-

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[87] Ibid., pp.27-28.

[88] Curtis D. Norenberg and Larry Lundblad, Distance Delivery of Vocational Education: Technologies and Planing Matrixes (St. Paul, MN: Minnesota Research and Development Center for Vocational Education, 1987).

[89] North Carolina State Department of Human Resources, Expanding Human Services Training Through Telecommunications: A Day Care Head Start Study: Executive Summary ERIC, ED 259 841 (Raleigh., NC: North Carolina State Department of Human Resources, 1985).

ate to the media; frequency of content delivery; length of teaching sessions; multiple vs single transmissions; and expanded applications for telecommunications technology.

Dutton and Lievrouw[90] caution that, since media differ in their suitability for different educational tasks, media selection must be "content-driven" rather than "technology-driven,"[91] that consideration of instructional content, the need for involvement, and particular learning outcomes desired should provide the primary basis for technology choices. They discuss many old and new educational media and compare them on the basis of kind of communication supported (one-way, reactive, two-way), ease of modification, expense, complexity, and learning taxonomies (cognitive, affective, psychomotor).

Wagner and Reddy[92] echo this caution against "hardware driven" design decisions, which are often based on the assumption that teleconferencing is suitable for the delivery of all educational programming or that one particular technology is suitable for all situations. They present a conceptual foundation for instructional programming based on a four-stage process on "a continuum of abstract-to-concrete, theoretical-to-applied, process-to-product activities."[93] Implementation of this process, they contend, will encourage design decisions made from a holistic orientation which includes consideration of learning theory (abstract, theoretical, process), instructional theory, instructional development, and instructional delivery (concrete, applied, product). In order to further aid in media selection decisions, they present a discussion of the unique transmission characteristics of four modes of teleconferenced delivery: audioconferencing (good for discussions of abstract concepts); audiographic teleconferencing (combination of verbal messages and visual materials provides both abstract and concrete learning experiences); videoteleconferencing (permits audio and visual interaction, thereby enhancing learner "satisfaction"); and computer conferencing (allows convenient transmission of text or graphics).

COURSE AND CURRICULUM DEVELOPMENT

Whether designing an entire curriculum, a single course, or a supplemental component of a course or unit, certain principles of instructional design must be incorporated into the planning to insure a successful teaching/learning experience.

Parker and Monson[94] introduce the concept of "teletechniques," design components often taken for granted in face-to-face situations, but crucial to success of distance education experiences. The techniques which these authors contend must be incorporated into course development are humanizing, participation, message style, and feedback.

Humanizing refers to the creation of an accepting environment which breaks down the barrier of distance and generates feelings of rapport between teacher and students. Supplying student pictures to all sites and addressing participants by name are examples of easily implemented humanizing techniques. Participation deals with the extent of interaction among participants in the teleconferencing situation. Instructor enthusiasm and encouragement, site-to-site discussions, buzz groups, and role playing all encourage active participation. Message style refers to ways of enhancing the interest and appeal of a presentation. Planning for short instructional segments, varying tone of voice and volume, and supple-

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[90] W. Dutton and L. Lievrouw, "Teleconferencing as an Educational Medium," Teleconferencing and Electronic Communications, (1982). pp. 108-114.

[91] Ibid., pp.113

[92] Wagner and Reddy, op. cit., pp. 49-56.

[93] Ibid., p. 50.

[94] L. Parker, and M. Monson, "Teletechniques: An Instructional Model for Interactive Teleconferencing," The Directional Design Library, vol. 38 (New Jersey: Educational Technology Publications, 1980).

menting programs with visual aids aids in maintaining the interest and attention of students. Feedback allows instructors to determine if their presentations were clear and effective. Both verbal and written feedback should be obtained, and can include questionnaires, interviews, or group reports.[95]

Hezekiah[96] applies the concept of "teletechniques" to a credit course for nurses. Such elements, she contends, are necessary for the successful implementation of teleconferencing classes, and evaluation must be conducted to measure the extent of such success. Evaluation of each of the four elements is discussed from both the students' and the teacher's perspectives; overall administration of the course is also assessed from these perspectives. She concludes that these independent evaluations revealed similar as well as different concerns and satisfactions, and offers nine recommendations for enhancing the teleconferencing experience for both students and teachers. Included in the recommendations are: purchase of increased learning resource materials for remote sites; visible, tangible support to instructors; availability of a toll-free number for use by students and faculty; and recognition by administrators that planning and implementation of teleconferencing courses requires greater expenditures of faculty time and effort than does that for traditional courses.

Assuming that the principles of effective teleconferencing are followed, what type of curricular offerings are appropriate to distance education formats? Even a cursory review of the literature reveals a wide variety of basic, supplemental, and enrichment programming offered at all levels of instruction.

The Arts and Sciences Teleconferencing Service, based at Oklahoma State University, began offering courses in German to High school students in 1985; they have since added Calculus, Physics, History, Government, Russian, Chemistry, Basic English and Reading, and Applied Economics. Classes are broadcast two or three times a week, with computer-assisted student activities under the supervision of local teachers occupying the remainder of the week. The local teleconference facilitators, who support student efforts, hand out materials, and serve as intermediaries with the master teacher, attend special training sessions designed and provided by OSU.[97,98]

In 1986, Eastern Washington University began broadcasting Spanish, Pre-calculus, Advanced English, or Japanese to eighteen school districts in Eastern Washington. Two-way audio and one-way video signals are transmitted live via satellite to over 200 students. Tests and homework are mailed to the university campus, where graduate students quickly grade and return them. Each remote class is supervised by an on-site facilitator trained by the master teacher for the course.[99]

Audioconferencing is used to provide basic programming in Nebraska. Sponsored by ISHS, the TeleLanguage program combines independent study and regular conference calls to teach French, Spanish, and German. Students in twenty-four school districts participated in 1987-88.[100,101]

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95 Ibid.

96 Jocelyn A. Hezekiah, "Teletechniques: A Case Study in Impementation and Evaluation," Teleconferencing and Electronic Communications V, (1986).

97 Ed: The Distance Education Report, "Satellite Delivery: What is Going Up for K-12," vol. 3, No. 3, 1989, pp. 7-18.

98 Clark, op. cit.

99 Batey and Cowell, op. cit.

100 Wall, op. cit.

101 Independent School High School, informational materials (Lincoln, NE: University of Nebraska-Lincoln Independent Study High School, 1988).

The Satellite Educational Resources Consortium (SERC) uses satellite and computer technology to delivery basic programming to secondary schools in eighteen states.[102] Satellite, microwave and cable technology deliver instruction in Japanese, Russian, Probability and Statistics, Discrete Mathematics, AP Economics, and Science, Technology and Society. Students interact with instructors via telephone, computer, and keypad technologies.

As Clark[103] points out, "distance education can include learning experiences other than full-fledged courses. Special broadcast events and projects...are also part of distance education." Second graders in Illinois have used live text-based conferencing to "talk" with a children's book author.[104] Using a microcomputer equipped with a modem and telecommunications software, they entered the Student Forum, part of the CompuServe Information Service, and joined other schools in the conference. Following set protocols, the students "raised their hands," waited to be "called on," entered questions on their keyboards, and were answered on-screen by the author.

SciStar Satellite's "The Shoulders of Giants" series provides enrichment events in which high school and middle school science students are able to interact with leading expert in fields such as paleontology, brain hemisphericity, superconductivity, and underwater archaeology.[105] Teachers who take part in SciStar programming along with their students can earn continuing education or graduate university credit by developing implementation plans for the programs.[106]

In addition to providing basic educational programming, the TI-IN Network offers student enrichment programs on a variety of topics. "Japan: A land of Contrasts," "Exploring Caves and Culture in Oaxzco," "Ecosystems News at Noon," and "Christmas in Mexico," are examples of current student enrichment classes. Programs on career counseling, drug and alcohol awareness, and SAT review courses are also available.[107]

One final consideration important to course and curriculum development is the issue of who designs and evaluates courses. Downing, in her 1984 "Survey on Uses of Distance Learning in the United States"[108] found that, of the fourteen states indicating systematic implementation of distance education, only one used teachers to design courses delivered via educational technology. The other states relied on a variety of sources: national consortia, university units, or independent vendors, for example. Downing expresses concern that the exclusion of teachers from the design process will result in distance education that is truly distant: removed not only from the presence of the learner but from the control and/or influence of the teacher, as well. Such a situation could have profound implications on the level of teacher commitment to any distance education program.

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[102] Ed: The Distance Education Report, op.cit.

[103] G. Christopher Clark, "Distance Education in United States Schools," The Computing Teacher, vol. 16, No. 6, 1989, p.11.

[104] Handler, op. cit.

[105] Clark, "What Goes Up," 1988.

[106] Ed: The Distance Education Report, op.cit.

[107] Ibid.

[108] Diane E. Downing, "Survey on the Uses of Distance Learning in the U. S.," ERIC, ED 246 874, (Austin, TX: Southwest Educational Development Laboratory, 1984).

USE OF TELECOMMUNICATIONS FOR TEACHER IN-SERVICE TRAINING

Prevalence

South Carolina reports extensive use of television and radio broadcasts for the staff development of educators.[109] Topics offered include courses in adult education, career education, the arts, classroom management, computer education, early childhood education, teaching techniques, and television production techniques. Twenty-five per cent of broadcast time is devoted to certification renewal credit courses.

Oklahoma State University's Midlands Consortium Star Schools Project offers in-service programming for educators.[110] Programs for April, 1989 included "Designing K-8 Learning Environments" and "Distance Education: Is The Sky The Limit?".

The Satellite Educational Resources Consortium (SERC) offers teacher training and in-service programming to instructors in member state or local education agencies.[111] The following courses are scheduled to be offered during the 1989-90 school year: AP Calculus for teachers, AP Economics For Teachers, Current Issues in Education, Teacher Training in Inquiry Based Science, Telecommunications for Educators, and Algebra I for Teachers.

TI-IN also provides teleconferenced training for teachers. Projects members such as California State University, Mississippi State University, and Western University Illinois develop and offer credit courses in areas such as mathematics, science, and career and guidance training.[112]

Levinson[113] notes that students in vocational education programs in Iowa receive courses leading to certification via audiocassette and telephone. Another program in Iowa, the Physics Resources and Instructional Strategies of Motivating Students, and the Kansas State University Regents' Continuing Education Network also provide inservice teacher training via teleconferencing.

Effectiveness

Few studies have focused on the effectiveness of distance education for in-service training. Nunley[114] discusses a study to compare the effectiveness of telelecture to face-to-face instruction for the retraining of mathematics teachers. Pre-tests and post-tests of achievement, mathematical ability, and attitudes showed a significantly greater mean change in content mastery for the group receiving instruction by telelecture than for the face-to-face group.

In another effort to determine the effectiveness of distance education for in-service teacher training, Kirman and Goldberg[115] studied two groups of teachers instructed about

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109 Ibid.

110 Ed: The Distance Education Report, op.cit.

111 Ibid.

112 Ibid.

113 Cynthia Y. Levinson, "The School Problem-Solver's Guide to Distance Education," ERIC, ED 253 380, (Austin, TX: Southwest Educational Development Laboratory, 1984).

114 B. G. Nunley, "A Study of the Effectiveness of Telelecture in the Retraining of Elementary Teachers in Mathematics," unpublished doctoral dissertation, The University of Texas, 1965.

115 Joseph M. Kirman and Jack Goldberg, "One Way Television with Simultaneous Telephone Group Conferencing Using Satellite Maps as a Monitoring Device," ERIC, ED 224 460 (A Report to the Innovative Projects Fund, 1980).

Landsat satellite maps. One group received traditional face-to-face instruction while the other group was instructed via one-way television and simultaneous audioteleconferencing. Both groups had the same instructors and used the same materials.The majority of the teachers rated the teleconferencing method as either acceptable or desirable; however, a substantial minority felt the method was undesirable. Teleconferencing rated higher than face-to-face instruction for comfort and convenience, but lower for interactive elements. There was no significant difference in the two groups' perceptions of the effectiveness of either method for imparting knowledge.

Kirman and Goldberg then compared groups of students instructed by these teachers on the basis of their ability to interpret maps. They found that pupils taught by teachers instructed via teleconferencing scored significantly higher on a map achievement test than did those taught by the controls. They conclude that, although the presence of uncontrolled variables makes attributing differences directly to the mode of instruction impossible, it can be stated that teleconferencing is effective for imparting knowledge and skills.

PROFESSIONAL DEVELOPMENT NEEDS OF DISTANCE EDUCATORS

Many of the authors reviewed have suggested that the success or failure of technologically mediated educational experiences depends to a large extent on the skill and commitment of the teachers and facilitators who are directing those experiences. The issue of how appropriate skills should be taught, and high levels of commitment encouraged, is important to the continued and increased success of technologically delivered educational programming.

Riccobono,[116] in a survey of schools of education and teacher training programs (undergraduate and graduate), examined the extent to which future teachers and administrators are trained in distance education technologies. He reports that 84% of the institutions surveyed offered training in the instructional use of computers, 64% in the instructional use of video, and 55% in the instructional use of audio technologies. He notes, however, that such courses deal primarily with operation of equipment (93%, 94%, and 95% respectively). Only 52% of the institutions offered training in the management of small groups of students using computers, only 37% offered instruction in the use of live interactive TV for instruction, and only 26% offered courses in the use of audio technologies in instruction. When he examined the extent to which these particular courses were required, the percentages were considerably lower: 17%, 17%, and 13%, respectively. Riccobono's data provides strong evidence that those who will be asked to make distance education program design decisions, as well as those who must actually implement such programs, are not being trained at the early stages of their professional development. At what stage is such training taking place? Batey and Cowell contend that

> With only a few exceptions, the best training is little more than a quick effort at the last moment before implementation or after problems have already appeared. Often teachers are left to grapple with the new programs on a "sink or swim" basis under the assumption that no training is required.[117]

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[116] J. A. Riccobono, Instructional Technology in Higher Education: A National Study of the Educational Uses of Telecommunications Technology in American Colleges and Universities, ERIC, ED 278 369, (Washington, DC: Corporation for Public Broadcasting, 1986).

[117] Batey and Cowell, op, cit., p.16.

Many of the reports reviewed mention the desire of instructors to receive early, appropriate training for these unfamiliar teaching experiences. Gilcher and Johnstone[118] note that the most frequently received faculty suggestion was to provide them with more training on how to effectively use the technology to teach distant students. Benning[119] reports that faculty members in the LearnAlaska Network also voiced a desire for appropriate and adequate preparation for distance teaching. Faculty-identified professional development needs in that program included:

1. notification of the amount of time needed to prepare and teach distance delivered courses
2. instruction in methods to establish and maintain effective communication with distant students
3. discussion of the experiences of other faculty members
4. strategies for adding visual components to audio courses
5. strategies for increasing interaction both among students and between students and faculty
6. discussion of the planning and management of organizational details involved in distance delivery
7. strategies to encourage group cohesion and student motivation

The literature includes many examples of general and specific guidelines for training teleconference facilitators or teachers. Gilcher and Johnstone,[120] in their review of the use of audiographics in educational settings, note that the "ideal" teaching/learning environment would provide instructors with training on both the technical aspects of the system and the strategies for teaching students at a distance. Additionally, teachers would have assistance in developing instructional graphics, and would be formally recognized and compensated by their institutions for the first time they develop courses for the telecommunications system. Weaver[121] contends that

> students are video and audio consumers and are constantly exposed to high quality production....They might not expect the same production values in a college credit course but they will get bored and lose interest quickly if some basic production values are not there. a faculty training program.[122]

To encourage high quality programming, he suggests that faculty training workshops should

1. acquaint instructors with the latest in instructional telecommunications equipment
2. provide instructors with a general understanding of the proper use of the various media for instructional purposes
3. provide opportunities to practice using the technology for instruction
4. discuss the potential problems involved in distance teaching

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118 K. W. Gilcher and S. M. Johnstone, A Critical Review of the Use of Audiographic Conferencing Systems by Selected Educational Institutions (College Park, MD: The University of Maryland University College, 1988).

119 M. Benning, "Considerations in the Instructional Use of Audio Conferencing: A Faculty Perspective," Teleconferencing and Electronic Communications IV, (1985), pp. 37-41.

120 Gilcher and Johnstone, op, cit.

121 G. Weaver, "The Development of a Workshop to Train Faculty to Effectively Use Telcommunications," Teleconferencing and Electronic Communications, (1982), pp. 293-298.

122 Ibid., p. 293.

In addition to appropriate training, professional distance educators must receive administrative support that reflects a belief in the importance their efforts to become effective teachers-at-a-distance. Byerly, Steinhart, and Swinsick (cited in Gilcher and Johnstone[123]) describe the administrative support given to those receiving professional school-based in-service training for Pennsylvania's Teleteaching Project:

1. Teleteachers will be provided seven (7) days of substitute coverage in order that they may visit the satellite sites and receive advanced training.
2. Teaching Associates will be provided four (4) days of substitute coverage in order that they may visit the transmitting site and other satellite locations and receive advanced training.
3. Both teleteachers and teaching associates will be provided with appropriate travel funds.
4. Once a semester teleteachers will visit other teleteachers.

COST EFFECTIVENESS OF DISTANCE EDUCATION

A determination of the cost-effectiveness of technologically mediated instruction is generally based on several considerations. The cost of educational telecommunication compared to the cost of traditional delivery (and to each other), potential savings due to lowered travel expenses or the hiring of fewer teachers, and the possibility of increased enrollments are a few of the factors which must be taken into consideration in any attempt to determine the extent to which distance education technology is cost-effective.

Staff at the AT&T National Teletraining Center have developed a model to assist clients in selecting media appropriate to their budget and needs. This spreadsheet model "incorporates charts figures, and formulae based on industry-accepted values or other values determined by experts in the field of instructional technology."[124] This model, with figures provided by the client, compares the basic costs of six delivery options on the basis of costs for equipment, maintenance, instructors, support staff, and delivery of instruction.

Another model for determining cost effectiveness is provided by Markowitz.[125] He discusses earlier studies comparing the cost of providing higher education at a distance to providing traditional higher education, and provides a framework for determining the "break even" point of a distance education program based on an analysis of fixed and variable costs.

Kullen[126] discusses the hardware, distribution and production costs of teleconferencing. She investigates the uses of teleconferencing in corporate and public settings, describes the various modes of teleconferencing available, and examines both intangible and quantifiable benefits offered by these modes of communication. Kullen goes on to present the benefits of both leasing and purchasing teleconferencing equipment or systems and advances suggestions for determining whether the cost of teleconferencing is a justifiable expenditure. She concludes that, if a long term perspective, influenced by both quantitative and intangible factors, is taken, many non-profit organizations will find that

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123 Gilcher and Johnstone, op. cit.

124 Alan G. Chute and Lee Balthazar, An Overview of Research and Development Projects at the AT&T National Teletraining Center (Cincinnati, OH: AT&T National Teletraining Center, 1988), p.4.

125 Hal Markowitz, "Financial Decision Making--Calculating the Costs of Distance Education," Distance Education, vol. 8, No. 2, 1987.

126 M. Kullen, "Evaluating the Benefits of Teleconferencing as a Capital Investment," Teleconferencing and Electronic Communications III, (1984), pp. 157-63.

teleconferencing is an affordable, viable means of sharing information, disseminating research, or supplying programming.

Batey and Cowell[127] suggest that the measurement and analysis of costs, an important component of the summative evaluation of any program, should include the following elements: a model for obtaining and analyzing cost information; determination of overall costs, component costs, and per student costs; determination of the cost of alternative delivery methods; a record of all cost data, including "already paid for" costs; and a relating of costs to educational gains.

The literature on teleconferencing presents many reports of cost-effectiveness studies, studies which provide considerable evidence that technologically mediated instruction can be cost-effective. Christopher[128] reports on a cost comparison study between the Teleteach Expanded Delivery System (TEDS) and resident instruction for providing needed instruction to Air Force students at remote sites. During a two year period, 2982 students (1247 at remote sites) were involved in this project. For the first year, system costs were reported at $272,421 and cost avoidance (based on estimated cost of transporting students to on-site training) at $795,829, resulting in a cost benefit of $523,408. In the second year system costs were $224,718 and cost avoidance $695,151 for a savings of $470,433. The two year, ten site program thus resulted in a total cost benefit of $993,841.

The cost-effectiveness of delivering 5377 contact hours of continuing education to professionals via audio teleconferencing was examined by Showalter.[129] Cost savings were based only on travel costs; food and lodging were not included due to the variability of estimates. Researchers computed that during the project 282 consultants would have traveled 519,958 miles to deliver 991 hours of face-to-face instruction. The estimated cost for this travel (at $ 0.31/mile air fare or $0.21/mile by automobile for distances under 400 miles) was $156,271. The actual cost of teleconferencing was $69,635. The savings of $86,636 represented a 55% cost benefit.

In 1986 AT&T realized significant cost savings resulting from the avoidance of travel costs and productivity related costs.[130] During that year 3176 students attended teletraining sessions. Without such sessions, students would have had to travel to Cincinnati to receive training. Estimated savings from travel, meals, and lodging were $500 per student per course, for a total savings of $1,588,000. Avoidance of non-productive time for students (estimated at six hours per student) saved an additional $457,300. The company incurred teletraining costs of $234,900. Total cost benefits realized were $1,810,400 for one year.

Ellertson and associates[131] conducted a national survey on the cost effectiveness of distance learning in the schools. Responses received represented thirty-four classes serving 812 students in forty-seven schools. Equipment startup costs ranged from $3000 for one type of audiographics system to $60,000 for microwave. Transmission costs ranged from $75 to $966 per course per month. While teacher costs were relatively constant, the cost of paying monitors varied greatly, depending on whether or not certified teachers were

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127 Batey and Cowell, op. cit.

128 Christopher, op. cit.

129 R. G. Showalter, Speaker Telephone Continuing Education for School Personnel Serving Handicapped Children: Final Project Report 1981-82, ERIC, ED 231 150 (Indianapolis, IN: Indiana State Department of Public Instruction, Indianapolis Division of Special Education, 1983).

130 Allan G. Chute, M. Hulik, and C. Palmer, "Teletraining Productivity at AT&T," paper presented at International Teleconferencing Association Annual Convention (Washington, D.C.: May 5, 1987).

131 E. Kent Ellertson, Dennis Wydra, and Henry Jolley, Report on Distance Learning: A National Effectiveness Survey (Mansfield, PA: Mansfield University and the Pennsylvania Department of Education, 1987).

required to supervise students at remote sites. In fifteen of the thirty-four classes, the cost per student for the distance delivery system was shown to be lower than with a live teacher. In most cases, the courses would not have been offered in the traditional format.

Ellertson provides several recommendations for improving the cost effectiveness of distance education: 1) lower transmission costs by using voice/data modems, dedicated lines, call-forwarding, and toll-free lines; 2) increase the number of participating sites; 3) increase the number of courses per day; 4) lower the cost of monitors at remote sites by using paraprofessionals; 5) increase the number of students; 6) lower the startup costs (use audiographics instead of microwave); and 7) keep the cost of the teacher low by having students at the originating site.

Rule, DeWulf, and Stowitschek (1988)[132] describe a three year federally funded model and demonstration project for providing inservice training via video teleconferencing supported by an electronic mail system. In order to provide an accurate picture of the cost effectiveness of developing and maintaining this program, the researchers developed a model of economic analysis of videoteleconferencing based on a comparison of the actual costs of this project and the estimated costs of an equal amount of face-to-face training. No comparison of the educational effects of each alternative was made.

During Year One training via videoteleconferencing was provided to one site; an additional site was added during Year Two and Year Three. Training, development, monitoring, and evaluation costs (combined under the terms "training costs") included costs for personnel, travel, office supplies, operations and equipment, and routine communications between staff at each site. Actual costs of teletraining were used to estimate face-to-face training costs. Costs for personnel time, travel, and supplies were included in the estimate.

This study reports that during Year One, in which only one site was used, costs for teletraining and face-to-face training were almost identical ($29,246 vs. $29,863). During the next two years, however, when additional sites were added and system charges decreased (due to sharing with other users) teletraining resulted in major cost savings; the costs were $30,718 vs. 62,077 for Year Two and $18,148 vs. $55,404 for Year Three. The conclusions in this report are supported by detailed graphs and tables which present actual and estimated costs of each aspect of the program (personnel, travel, supplies, telecommunications, routine communications, and site costs).

STATE POLICIES DEDICATED TO DISTANCE EDUCATION.

Various states began to develop policy concerned with distance education in the early 1980s. Many are informed by "inventory studies" and recommendations to a planning process. In some states, the inventory is the single document and policy has not yet followed. Obviously, with exponential change in distance education technology and countless institutions within and outside each state engaged in the new delivery of new programs, inventory reports are quickly outdated. A second policy type which emerges is an in-state coordinating "procedures policy" intended to enhance resource sharing and duplication of service.

States which have developed such seminal policies are listed below, but it is significant to note that each has tended to work in general isolation from the other.

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[132] Sarah Rule, Michael Dewulf, and Joseph Stowitschek, "An Economic Analysis of Inservice Teacher Training," The American Journal of Distance Education, vol. 2, No. 2, 1988, pp. 12-22.

A. Inventory Studies

The following are reports in which states have attempted to categorize the scope and range of their in-state activities; most include recommendations on specific, often regulatory issues concerning out-of-state program delivery [133]:

The Florida Satellite Network Study: Report and Recommendations of the Florida Postsecondary Educational Planning Commission[134] has been a basis for policy development in Florida and provides a comprehensive, detailed analysis of systems in existence in Florida.

The Coordinating Board of Texas College and University System studied the use of telecourses in 1983 and the Board adopted exemptions, standards, rules and regulations for televised instruction in January 1985. The need for institutional plans, self study and a statewide review is also discussed.

The Missouri Coordinating Board, in August 1988, received recommendations from a task force of its institutional representatives to facilitate policy development. Among the recommendations was a call for a further study.

Minnesota reviewed state-level higher education policy and, in 1986, developed regulatory policies for out-of-state programs together with policies addressing funding, faculty development, courseware development and protection of property rights when technology is used in distance education.[135]

Oklahoma State Regents for Higher Education adopted a broad policy statement in 1981 addressing credit course offerings by electronic or other non-traditional means. This was enhanced in 1985 with a report on the development of an educational telecommunications network by the Division of Educational Outreach of the State Regent Board. In February, 1988, The Regents approved the Policy and Procedures Pertaining to Off-Campus Programs, Electronic Media, and Non-traditional Methodology[136] providing a basis for authorization, purpose, standards, planning coordination, fiscal provisions, reporting and guidelines for telecourses.

B. Policies

The Minnesota and Oklahoma policies are both Inventory studies and policies regarding procedures, since they deal with authorization/regulation as well as fiscal provision, faculty development and coordination. Other states have sought to emphasize these elements even more, as seen below:

As early as 1977, the West Virginia Board of Regents addressed the rights and responsibilities of television teaching (in Bulletin No. 48). Their more recent Study of Cooperative Lines of Telecommunications Systems in West Virginia[137] makes recommen-

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[133] Richard England, "The Alabama Project," Distance Education in North America, Michael Moore, Joseph Donaldson, Peter Cookson, and Allan Quigley (eds.) in press.

[134] Florida Postsecondary Planning Commission, The Florida Satellite Network Study: Report and Recommendations of the Florida Postsecondary Education Planning Commission Report 2 (Tallahassee, FL: 1985).

[135] Minnesota Higher Education Board, Information Technology in Instruction in Minnesota Postsecondary Education Institutions with Coordinating Board of Recommendations (St. Paul, MN: 1986).

[136] Oklahoma State Regents for Higher Education, Policy and Procedures Pertaining to Off-Campus Programs, Electronic Media and Non-Traditional Methodology (Oklahoma City, OK: 1988).

[137] West Virginia Board of Regents, A Study of the Cooperative Uses of Telecommunications Systems in West Virginia: The Telecommunications Task Force Report (Charleston, VA: 1986).

dations to strengthen and enhance relationships and cooperation among the major providers of distance education in the public sector.

The Kentucky Educational Television (KET) system and the Kentucky Council on Higher Education established the Kentucky Telecommunications Consortium in 1978. Its primary purpose was to coordinate college credit telecourses in a cost-effective system and, as a result of this policy, it has grown from 848 students in 1978 to 4,700 in 1987/88 in the consortium and today is seeking greater access and resource sharing among consortium participants.[138]

Maryland's higher education authority has established the Maryland Educational Video Network and the Maryland State Board for Higher Education has recommended the establishment of an Advisory Board on Instructional Technologies to address and coordinate the issues arising in distance education.[139]

Virginia, like Oklahoma, has bridged both regulatory and developmental policy. The State Council for Higher Education completed its Report on Telecommunications by the Task Force on Telecommunications in 1987.[140] It strongly recommends colleges and universities to accept telecommunications delivery as the primary delivery mode. Since that time, The Regulations Governing the Approval of Certain Institutions to Confer Degrees, Diplomas and Certificates[141] have been effective in Virginia to govern out-of-state institutions delivering courses in Virginia, including those by distance education means.

C. National/Institutional Policy Development

At least two major initiatives require recognition at the national level --both fostered by non-profit ventures.

The 1984 Project ALLTEL: Statement on Accreditation and Authorization of Distance Learning through Telecommunications[142] is a landmark in national policy. This report was supported by the Fund for Improvement of Postsecondary Education and developed by the Council on Postsecondary Accreditation (COPA) together with the State Higher Education Executive Officers Association (SHEEO). It has provided the focal point for state discussion and action, especially in its Joint Statement of the Accreditation, Authorization, and Legal Task Forces on Assessing Long Distance Learning Via Telecommunications. It seeks efforts among states to enhance their communication, sharing, and ensuring the quality as well as coordination across states.

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138 Kentucky Council on Higher Education, Kentucky Telecommunications Consortium: Action Item CHE (107) (Lexington, KY: 1988).

139 Maryland State Board for Higher Education, Telecommunications and Education in Maryland: Report and Recommendations of the Task Force on Instructional Technologies (Annapolis, MD: 1987).

140 State Council of Higher Education for Virginia, Report on Telecommunications by the Task Force on Telecommunications (Richmond, VA: 1987).

141 State Council of Higher Education for Virginia, Regulations Governing the Approval of Certain Institutions to Confer Degrees, Diplomas, and Certificates VR-380-02-01 (Richmond, VA: 1987).

142 State Higher Education Executive Officers Association, and Council on Postsecondary Accreditation, Project Alltel: Statement on Accreditation and Authorization of Distance Learning Through Telecommunications (Washington, DC: 1984).

The more recent Adult Learning/Information Technologies: A survey of Public Broadcasting in the West by the Western Interstate Commission for Higher Education (WICHE)[143] is a second major contribution based on a survey of public broadcasting in Western United States. This document called for a process involving policy makers at state/regional levels for adult learners around telecommunications issues. This, in turn, initiated a 1987 statement on policy issues: State Higher Education Policies in the Information Age.[144] It addresses policy issues for: institutions, state-level agencies, regional agencies, and accrediting agencies.

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[143] Western Interstate Commission for Higher Education, Adult Learning/Information Technologies: A Survey of Public Broadcasting in the West (Denver, CO: Pacific Mountain Network, 1985).

[144] Western Interstate Commission for Higher Education, State Higher Education Policies in the Information Age (Boulder, CO: 1987).

PART C.
IMPLICATIONS

GENERAL

The weight of evidence that can be gathered from the literature points overwhelmingly to the conclusion that teaching and studying at a distance, especially that which uses interactive electronic telecommunications media, is effective, when effectiveness is measured by the achievement of learning, by the attitudes of students and teachers, and by cost effectiveness.

To this optimistic conclusion it is necessary to append several reservations. The sheer weight of opinion in the literature should not be taken as conclusive of itself, since most of it is based on anecdotal evidence offered by persons and institutions with vested interests in the techniques being evaluated, or in the very programs they are evaluating. Furthermore in those studies where some attempt has been made to gather empirical data, the research has been undertaken by schoolteachers or university faculty with extremely limited resources, and as a result the methodology of many of the research designs is weak, with regard to such factors as the populations being compared or otherwise studied, the treatments being given, the statistical techniques being applied, and the validity, reliability and generalizability of the data on which the conclusions are based.

It is also very important to distinguish between conclusions that may be reached on the basis of evaluation research, which is the kind of research that has provided most evidence for the optimistic conclusion above, and basic research, of which there has been very little. The difference in the purposes of the two kinds of research is made clear in the following statement about evaluation projects in distance education:

> "..it is unlikely they were done with a research focus in mind and as a result probably have little in the way of external validity, and are not linked to existing research ..., and perhaps do not reflect an interest in providing information for anyone not connected with the program being evaluated.

Such evaluation research:

> "..is not typically concerned with prediction or control of variables that generalize beyond the primary setting and as a result can often be done less expensively than research for the overall improvement of a given system or institution."[145]

To support the conclusions from experience, anecdotal reports and evaluation research an immediate and vital need is to develop a program of research that will be generalizable beyond the primary setting, and that will give the power to predict and control variables in the distance education environment. To bring about this kind of research it will be necessary to develop a total systems model, and then to develop and integrate knowledge about the distant learner, teacher, administrator, social system, and communications technology.

It also has become apparent that research is urgently needed into the procedures by which states are forming their policies with regard to distance education, and what those policies are.

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[145] Dan O Coldeway, "Methodological Issues in Distance Education," The American Journal of Distance Education, vol. 2, No. 3, 1988. p.49.

The primary conclusion of the reviewer is that there is strong prima facie case for believing in the effectiveness of distance education through interactive telecommunications; that the implications of this for the future overall improvement of the states' and the nation's educational systems are so promising as to warrant investment of money, time, and human resources in a thorough, integrated national research program. This program should not only evaluate existing projects, but should institute a series of projects of rigorous research design to measure the fundamental dynamics of learning and teaching by telecommunications and its most effective organization, as well as the procedures and nature of policies regarding the development of such education.

As a rider to the above conclusion, it is suggested that where funding is provided for further implementation of distance education it is only on condition that well designed and adequately funded evaluation is proposed as part of the submission for funding.

Some of the directions that research, both basic and evaluation, might take will be indicated in the remainder of this report. This is not intended to be exhaustive, however, and **it is suggested that at an early stage an exploratory research group might be established to develop a research model and begin to specify the main research needs more formally.**

THE NEED FOR STRATEGIC PLANNING.

Orderly, well planned, introduction of distance education through interactive telecommunications, and its successful implementation, is threatened by the too-cautious interpretations of distance education by many long-established educational administrators. On the other hand it is threatened also by overselling and well intentioned "hype" from the communications industry, where each vendor has a product that is potentially useful to the educators, but only as part of a total educational system that is beyond the understanding of the sales persons. The vendor's enthusiasm for one product, impacting on busy educational administrators and other decision makers who are also not well informed about distance education as a total system, can result in schools or school systems purchasing partial technologies. These are technologies that are good in themselves, but of reduced effectiveness because they are not part of any well thought out, integrated, system and therefore do not fit with other technology, the teacher cadre, medium and long term curriculum or instructional planning. They therefore fall short of their potential.

There is need for state, and national STRATEGIC planning, planning that cannot be done on a small scale by local administrators, though representatives of schools will have an important part in the planning, and an equally important part in the next, local, planning stages and in the implementation of such plans.

The current, pluralistic approach, with the resulting conceptual, research and implementational anarchy is neither in the interests of education or of the telecommunications industry, and leads to the following conclusion:

Establish education-industry planning teams at national, state and local levels to plan and implement the establishment of integrated delivery systems, and determine telecommunications needs and select hardware as part of education-driven total systems.

IMPLICATIONS REGARDING LEARNING

While there is considerable evidence of the effectiveness of distance education in bringing about learning, many questions remain unanswered. Many of them can be subsumed under the research paradigm of Treatment X Learner Interaction. While there is evidence, either anecdotal, such as the casual observation of school teachers or principals, or post-hoc measures on single groups, there are few studies that discriminate methodically among the different types of learners who learn successfully. At the most basic level, most K-12 projects have targeted "gifted" learners, but too little with "mainstream" learners, or "special" or slower learners. Besides this crude distinction based on previous school achievement, learners should be distinguished by such variables as personality and socio-economic characteristics, to ascertain the significance of individual differences in learning achievement. Within the teleconference family of communications various teaching techniques are, or should be employed. Which of these do learners most prefer, and what type of learner prefers and learns best from each technique? Besides such "within groups" research there is even prior need for controlled "between groups" research with some effort at randomization of subjects, since the data presented so far has been either of single group evaluations, or where comparisons have been made there have been systematic biases in the constitution of the groups studied.

IMPLICATIONS FOR TEACHERS AND TEACHING

Research is likely to show that there are individual learner differences in response to distance education and its various techniques, as there are to classroom instruction, to particular teaching styles, even to particular teachers. In general, it seems likely that good teaching by teleconferencing and other distance education techniques has results no better or worse than good teaching by any other method, including good face-to-face instruction.

However the highly artistic teacher who is also advanced in a content area and able to "keep up" is rare, and distance education can distribute the work of such master teachers to large numbers of children who otherwise have to settle for the more ordinary. In other words the best of distance instruction is superior to average classroom teaching. However distance education requires a division of the activities of teaching to allow each teacher to specialize in such activities as developing course content, managing course design, developing and applying evaluation instruments and giving individual learner support, and the special skills of facilitating interactions by teleconference. Existing teachers and teachers in training are well able to acquire these, but in the majority of projects so far they have not been given the opportunity. There is some evidence that the success of distance education in the schools depends largely on the effectiveness of the teacher, and that this in turn depends on the teachers' knowledge, skill, enthusiasm and commitment to the innovation. It therefore becomes important to review the extent and quality of teacher preparation and in-service training in distance education, as well as the terms and conditions under which the teacher is expected to operate.

Training opportunities in distance education are desperately limited. Most in-service programs that deal with technology seem to center on how to run equipment with little attention to the more important aspects of how to incorporate technology into instruction, and virtually none into the concept and practice of distance education, i.e. a different organization as well as techniques of instruction.

Ultimately it is pointless to organize distance education projects if training cannot be given, since failure demoralizes the teacher, perhaps harms the students, and gives an otherwise promising new approach to education a bad reputation.

It is probably not advisable to permit vendors of either hardware or telecommunications services, including educational programs to conduct training, since they are not impartial in the advice they will give on selecting media and programs for particular students, schools and content. **A national training program should be set up. Most training of experienced teachers could be done "on the job" in the teachers' schools. Training of trainers could be coordinated around a limited number of centers of excellence at selected universities.**

Training will include: course design and curriculum development in distance education; skills and techniques of writing and recording teaching for both particular media and for the integration of media, including working in design and presentation teams; the production of written, recorded and teleconference teaching; planning and managing distance education systems at local, state and national levels; techniques of facilitating interaction; research and evaluation techniques; student support and counselling.

The attitudes of teachers and others who have given their professional lives to education also deserve attention. In particular there is a natural concern that technology will replace them in the classroom. Distance education generally, including teleconference education should not replace teachers. It may alleviate them of certain teaching tasks, to free their time to give better attention to others. It is important for teachers in training to be stimulated to a positive attitude to technology as a means of enhancing the quality of the human interaction that is important in education, and not to see technology as a dehumanizing influence. For the teacher in service it seems likely that commitment will be a function of involvement in decision-making about the use of new technology, training in its use, and reward, or at least no penalty in such matters as job security, salary and time allocated to work. Teacher representatives need to be involved in both research planning and policy making.

IMPLICATIONS FOR MEDIA SELECTION AND USAGE

It is very important, and difficult because of the generally low intellectual and aesthetic quality of broadcast television in this country, that when electronic media are used in education they exhibit high standards of content as well as production values. There is frequent confusion of the purpose of using the media in education with their use in entertainment and advertising, and it is vital that influences from these areas do not overwhelm the values and purposes of educators. **Educators must remain in charge of distance education, and research is required into a number of questions concerning the selection and educational use of these media. One of particular importance is that of the relative effectiveness of each medium for particular teaching tasks.** In their enthusiasm for electronic media some educators overlook the critical importance of print and the written word in the achievement of most educational goals. There is little doubt that almost every distance education program requires, or is greatly enhanced by a study guide and readings of various types. The recorded media should be considered for the use of the students in their own time, under their own control. The fast, spontaneous interaction of the teleconference is not always the form of communication most appropriate for a particular learning objective. Research is needed to determine which learning needs are best met by which particular media, and in program development the applications of this research must by applied. It is critically important that media are only selected to meet defined learning needs, and it is wise to bear in mind that many learning needs that are currently the subject of very expensive media can probably be met by less expensive, less glamorous media. The power of print, recording and the telephone should never be underestimated. Numerous research questions need to be asked concerning the ways in which media are selected. By whom are they selected, and by what criteria ?

We also need to ask what training is given to the administrators and other decision makers who make these selections.

IMPLICATIONS CONCERNING THE QUALITY OF INTERACTION

Facilitating interaction by telecommunications in education is an art that is different from the art of broadcasting or even of conducting a teleconference meeting of business persons on the one hand, or of conducting interaction in a classroom on the other. The key to the art is that the teacher actively USES the interactive nature of the media, resisting the temptation to lecture, which is better done through the recorded medium, and bringing learners frequently, indeed almost continuously, into action by asking questions, encouraging student presentations, getting students to talk to each other, and in other ways involving them fully in the teaching-learning process. **Further research and an emphasis in the training of teachers is needed concerning the techniques of facilitating interaction.** There is some disagreement concerning the need for on-site facilitators. However, until research suggests when such helpers may be needed, for which learners and what content, prudence would suggest they are provided whenever possible. They must be trained to aid the distant instructor, and not replace the instructor's role, but they can provide assistance to learners at their sites, and help in individualizing content.

IMPLICATIONS FOR EDUCATIONAL SYSTEMS AND ORGANIZATIONS

There is no identifiable pattern concerning successful and unsuccessful adoption of new technology. **Research is needed concerning the sociology of successful adoption of new technology by schools and other levels of organization of education. This is likely to be based on theories of adoption/diffusion. What are factors leading to successful adoption in places, rejection in others? It is suggested a survey reviews projects in all 50 states to identify reasons for success and failure.** One hypothesis suggested by the literature is that success depends on the extent to which there is a transfer in the motivation for the project from that of external funding to internal commitment by the teachers. If this is so, it further reinforces the importance of teacher attitudes and teacher re-training.

IMPLICATIONS CONCERNING DOCUMENTATION

The rapid expansion of distance education in the United States and in other countries has been paralleled by an expansion in the volume of literature and data emanating from distance teaching institutions. Potential users of such literature and data come from a variety of areas within distance teaching institutions, and from institutions not currently teaching at a distance. The sources of many of these types of information are not held by conventional libraries since they are either unpublished or semi-published. The most effective way of storing and making available the literature and data on distance education is through a separately administered documentation center. Several nations around the world have now established such centers, most notable of which is the International Documentation Center based at the Open University in Great Britain with a special responsibility to gather documentation for the new Commonwealth of Learning throughout the British Commonwealth.

Establishment of an American Distance Education Documentation Center would provide a valuable clearinghouse for practitioners and policy makers in this country and would also become part of the worldwide network of documentation centers now being established. This will have the added benefit of facilitation international exchange and cooperation between

distance education practitioners and policy makers, and scholars in this country and their counterparts in other countries.

IMPLICATIONS CONCERNING POLICY FORMATION AND POLICY RESEARCH

Federal, state and local policies with regard to distance education have only begun to emerge in the past decade, and have not kept pace with either the pace of change in communications technology, or even the response of educators to the new teaching-learning opportunities opened up by the new technologies. Policy research has meant little more than occasional studies and recommendations to planners, aimed at the development of procedures for coordination and regulation, with consistent concerns being: accreditation and regulation of credit programs delivered by distance education, especially out-of-state delivery; funding of such delivery; enhancement of resource sharing among and cooperation among institutions; reporting and accountability issues; and, in a few cases, faculty development.

Conspicuously absent is a policy role by the Federal Government. Also absent is any process to establish clear linkages among institutions, state, intra-state, regional and federal level policy makers. It is also notable how few academic or Higher Education organizations have entered the field to research the issues of policy formation in distance education.

Against this background the following questions are proposed for research at an early stage:

1. What processes, procedures or structures for determining policies might prove effective for developing a multi-level interchange among major institutional providers, leading states, key non-governmental agencies and federal agencies to oversee the orderly development of distance education?

This question assumes both a regulatory function respecting issues of standards, accreditation, state and institutional legal obligations as well as developmental functions enabling resource sharing, sharing of formative and summative evaluation, faculty and course development, learner support and counselling services, etc..

The question might be addressed in the first instance by studies of policy making procedures in other countries, especially Great Britain, Canada, and Scandinavia, where distance education has achieved a well-integrated position in the educational system. The question could also be addressed by looking for examples of such inter-institutional collaboration in areas of large scale national need outside the education sector.

The establishment of an American Distance Education Documentation Center would contribute to the dissemination of policy documents which would be a contribution to informing the states about recent policy developments as well as key policy research issues.

2. What should be the role of the Federal Government, States, not-for-profit and other institutions in the further development of distance education?

This question asks who is to be given the leadership responsibility in what ought to be large scale, and therefore multi-institutional, multi-regional, sometimes global program development and delivery. One or two organizations like the Annenberg/CPB Project and the Star Schools consortia have filled the vacuum until now. Studies of the views of policy makers and others are needed, as well as perhaps studies of the effectiveness of organizations like the above, to resolve whether non governmental organizations and foundations could or should provide the major funding for distance education, or whether as in other

countries this is to be publicly funded provision. If it is left to philanthropic organizations, how can federal and state objectives for education be protected ?

3. What are the current perceptions, and expectations for the future of state, federal, and non-governmental policy makers?

This question seeks to understand the current and future directions distance education will probably take, based on the visions held by policy makers across government and key distance education organizations. To what degree to they want distance education to be an alternative to conventional education? To what extent to incorporate and to what extent to be incorporated into conventional education?

4. How can researchers and policy makers arrive at a prioritized research agenda to mutually inform and investigate key issues?

This question echoes two earlier statements, one on the need for a strategic national research planning group to determine research priorities, and the other the need for strategic, national planning of the development of distance education programming. Here the emphasis is on reaching agreement about research needs between the parties involved in policy formation and policy research. The question asks how research and dissemination of research can be organized to inform and guide policy across states at the federal as well as non-governmental level and asks how a mutually supportive prioritizing process can be arrived at. Unless practitioners, policy-makers and policy researchers can be organized to collaborate in this way the current duplication of effort and use of resources is likely to continue, but on a much larger scale.

5. How can distance education be used for the benefit of special target groups in society?

Unless special policy decisions are made and implemented there is danger that the potential for access to learning and its benefits offered by distance education will devolve to those who are already most capable and comfortable in accessing and using print and electronic systems. While the already educated and those able to afford technology may, as in the past, be the primary beneficiaries of education, the illiterate adult, the marginalized minority, the undereducated learner, the non-English speaker, the poor, may experience less access than ever.

What policies have been instituted to deal with this danger? How successful are they? What policies might deal with the problem? Who is thinking about this? What can be done about this ?

CONCLUSIONS REGARDING POLICY

It is essential, before further large sums of money and effort are expended, while distance education is still in its formative growth stages, that infrastructures and on-going processes are set up to provide reliable information to policy makers. These might include the following:

A. A consultative mechanism in which Federal and State policy makers can work out and coordinate a more proactive leadership position with regard to the facilitation, and not merely the regulation, of distance education, especially with regard to the rationalization of the use of resources, human and technical.

B. A national and also state strategic planning groups to prioritize needs, with a strategic plan for policy research receiving first priority.

C. Establishment at one or more leading research institutions of a program of coordinated investigative research on the national policy implications of distance

education, and equally importantly, a program to identify, gather, manage and disseminate documents on distance education policy and practice.

D. An investigation of international distance education policy experiences and research that provides information about the success of policy in other countries. Besides the immediate contribution to U.S. development it must be born in mind that international education by distance education is now evolving, and the U.S. has important foreign policy opportunities through its understanding of foreign distance education policies.

CONCLUSION

The gap between educational needs and educational provision in this country is wide, and there seems little hope that it can be bridged by traditional means. In communications technology, correctly applied it seems likely we have a way of bridging the gap and of solving many educational problems that themselves are a result of the technological age. However, the gap between the potential of distance education that uses communication technology and its application in American education is also wide. There is even a wide gap between the use of distance education in other countries and its use in the United States. There is opportunity in distance education that is not being taken advantage of. The review of literature reported in this paper leads to the conclusion that we have the means to open educational opportunity to more learners and to improve the quality of education for all, including lifelong, continuing education to the adult population. In spite of all the many unanswered questions, a considerable knowledge has been acquired in recent years in harnessing technology to education, and the gap between this knowledge and its wide application to our educational problems is unnecessarily wide. We can say with considerable optimism that when the distance education approach is correctly applied, it works well. Now it is time to move on from the period of small scale, uncoordinated and not well designed experimentation, too little coordinated planning of courses, too little cooperation in using delivery systems, too little over-all thinking by policy makers at state and national levels. It is time for large scale, coordinated research, large scale, well funded course design and delivery; well integrated, multi-media delivery systems, and state, inter-state, and national policy making and planning.